

What is claimed is:

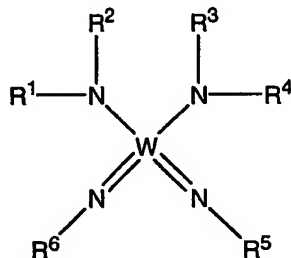
1. A process for depositing a thin film on the surface of a substrate by a sequential process including one or more cycles, wherein at least one cycle comprises:
 - exposing the substrate to a vapor of a first material containing at least two
 - 5 elements of the thin film, wherein at least a portion of the first material's vapor adsorbs on the surface of the substrate by a self-limiting process;
 - removing un-adsorbed vapor of the first material from the vicinity of the substrate;
 - exposing the substrate to the vapor of a second material that activates the surface so that the surface is prepared to react with additional quantities of said first material, said
 - 10 activation characterized in that elements of the second material are not incorporated into the thin film; and
 - removing residual vapor of the second material from the vicinity of the substrate.
2. A process as in claim 1 for forming a thin film comprising tungsten and nitrogen.
- 15 3. A process for depositing a thin film on the surface of a substrate by a sequential process including one or more cycles, wherein at least one cycle comprises:
 - exposing the substrate to a vapor of a first material comprising an element
 - selected from the group consisting of tungsten and molybdenum and containing at least
 - 20 two elements of the thin film, wherein at least a portion of the first material's vapor adsorbs on the surface of the substrate by a self-limiting process;
 - removing un-adsorbed vapor of the first material from the vicinity of the substrate;
 - exposing the substrate to the vapor of a second material that activates the surface

so that the surface is prepared to react with additional quantities of said first material; and
removing residual vapor of the second material from the vicinity of the substrate.

4. A process as in claim 3 in which said first material comprises one or more compounds
5 comprising tungsten-nitrogen bonds.

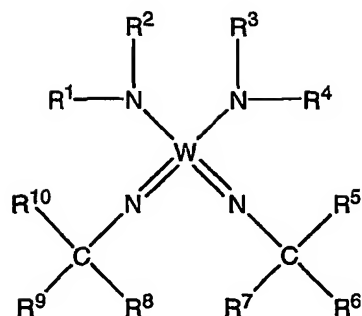
5. A process as in claim 3 in which said first material comprises one or more compounds
comprising molybdenum-nitrogen bonds.

10 6. A process as in claim 4 in which said compounds comprising tungsten-nitrogen bonds
have the general formula



in which R^n represents alkyl groups, arylalkyl groups, alkenylalkyl groups,
alkynylalkyl groups, fluoroalkyl groups or alkyl groups substituted with other atoms or
15 groups selected to enhance the volatility of the compound, where R^n is any one of R^1
through R^6 and where the R^n may be the same or different from each other.

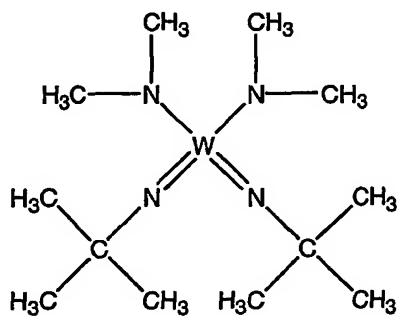
7. A process as in claim 4 in which said compounds comprising tungsten-nitrogen bonds
have the general formula



in which R^n represents alkyl groups, arylalkyl groups, alkenylalkyl groups, alkynylalkyl groups, fluoroalkyl groups or alkyl groups substituted with other atoms or groups selected to enhance the volatility of the compound, where R^n is any one of R^1

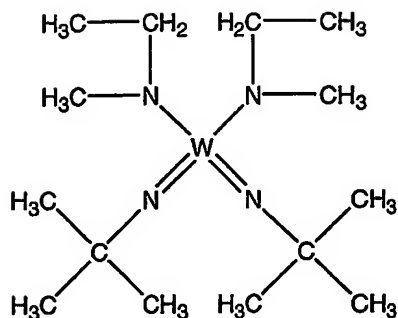
5 through R^{10} and where the R^n may be the same or different from each other.

8. A process as in claim 7 in which said compounds comprising tungsten-nitrogen bonds comprise bis(*tert*-butylimido)bis(dimethylamido)tungsten(VI) having the formula



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9. A process as in claim 7 in which said compounds comprising tungsten-nitrogen bonds comprise bis(ethylmethanimido)bis(*tert*-butylimido)tungsten(VI) having formula:



10. A process as in claim 3 in which said second material is a Lewis base.

5 11. A process as in claim 10 in which said Lewis base is ammonia.

12. A process as in claim 10 in which said Lewis base is pyridine

13. A process as in claim 3 in which said second material comprises a hydrogen plasma.

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14. A process as in claim 3 in which said second material comprises hydrogen atoms

15. A process as in claim 3 in which the substrate is maintained at a temperature in the range of about 200 °C to about 400 °C.

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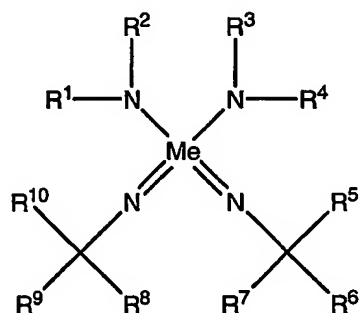
16. An electrical capacitor comprising one or more electrically conducting electrodes formed using the process of claim 1 or 6.

17. A barrier to diffusion of metals in microelectronic devices formed by the process of

claim 1 or 6.

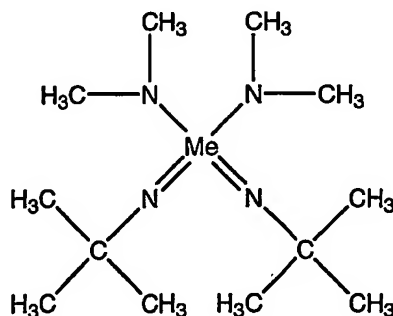
18. The diffusion barrier of claim 17 having a thickness within the range 1 to 100 nm.

5 19. A composition of matter corresponding to the chemical compound described by the formula



in which Me is W or Mo, R^n represent alkyl groups, arylalkyl groups, alkenylalkyl groups, alkynylalkyl groups, fluoroalkyl groups or alkyl groups substituted
 10 with other atoms or groups selected to enhance the volatility of the compound, where R^n is any one of R^1 through R^6 and the R^n may be the same or different from each other.

20. A composition of matter corresponding to the chemical compound described by the formula



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in which Me is W or Mo.

21. The composition of claim 19 or 20, wherein Me is W.

5 22. A process for depositing material from a vapor phase comprising contacting the
compound of claim 19 or 20 to a surface.

23. A microelectronic device comprising copper features, said device characterized in
that a layer of tungsten nitride deposited according to the process of claim 3 or 6 is
10 interposed between the device substrate and the copper feature.